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ABSTRACT

The determinants of student decisions to take or not take mathematics were studied. The variables selected for the study were derived from the expectancy/valve model of behavior. Choice is found to be influenced most directly by the utility valve of mathematics for attaining future goals and the interest of on-going mathematics activities. Students from fifth through twelfth grades were measured at two different points in time to gauge the effects of maturing one year. Among the findings were that all students rated mathematics as more useful for males than females. There were few sex differences found in responses when the number of years studying mathematics was equated for both sexes. The effects of grade or age level proved more numerous and generally stronger than the "sex effects" in the study. It was found that children become more pessimistic and negative about mathematics as they grow older. Tables include the survey questions and statistical analysis of the results. (MP)

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A Longitudinal Study of Attitudes Toward Mathematics in 5th through 12th Grades: Age and Sex Differences

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This paper was presented at the Annual Meeting of the American Educational Research Association in Boston, April 1980 as part of a symposium on "Modifiable Determinants of Students' Math Course Plans". The research reported in this paper was supported by grants from the National Institute of Education (NIE-G-78-0022) and the National Institute of Mental Health (5R01-MH31724-01).

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Researchers studying sex differences in mathematics achievement have consistently reported superior performance by boys as compared to girls (Aiken, 1976; Maccoby & Jacklin, 1974). However, many of the relevant studies have failed to control for the number of mathematics courses taken. Thus, males who have taken more mathematics courses are often compared with females who have taken fewer courses. It has been suggested by Fennema and Sherman and others (Fennema, 1974; Fennema & Sherman, 1977; Fox, 1976) that differential course taking by males and females accounts for a large portion of the sex differences found on test scores. When the number of years studying math is equated for males and females, the differences typically found on high school achievement tests between the sexes are few.

Since in most schools students have the choice of whether or not to continue in math after one year of high school math we proposed a study to explore some of the determinants of the decision to take or not take math.

The variables selected for study were derived from an expectancy/value model of behavior. This psychological model, based in part on decision, achievement, and attribution theories (e.g., Atkinson, 1964; Edwards, 1954; Weiner, 1974), links behavioral choice to both one's expectancy for success in that task and the incentive value of the task for the individual. Within this model, choice is influenced most directly by the students' values (both the utility value of math for attaining future goals and the attainment or interest value of ongoing math activities) and the students' expectancies for success at math. These variables, in turn, are assumed to be influenced by students' goals and their concepts of both their own math ability and the task

demands. Individual differences on these attitudinal variables are assumed to result from students' perceptions of the beliefs of major socializers, the students' interpretation of their past history of math performance and students' perception of appropriate behaviors and goals.

This paper will focus on the individual differences that were observed in the student attitude variables included in our model. Sequential strategies of data collection and analysis are used to examine ontogenetic(individual) as well as cohort(historical change) differences. Sex differences are also tested.

RESEARCH DESIGN AND METHODOLOGY

The study to be described here is a part of an extensive longitudinal and cross-sectional study. The goal of this study is the identification of the developmental origins and the relative importance of various factors which may mediate differential participation rates in mathematics by boys and girls. Our design is based on Schaie's General Developmental Model (Schaie, 1965) as modified and illustrated by Nesselroade and Baltes(1974). Shaie identified three factors which need to be addressed in developmental research: the effect of age, cohort(birth cohort) and time of measurement. He suggested that in order to establish empirically the relative importance of each of these factors in producing change, one must make the following comparisons: 1) subjects of the same age born in different years must be compared in order to gauge the effects of historical change; 2) subjects of different ages must be compared to gauge the effects of age on development; and 3) subjects' behavior must be measured at two different points in time to gauge the effects of maturing one year. Following

this design we collected data at two points in time from students ranging in grade level from 5th-12th. In addition a control sample was measured at the second time of measurement in order to test for testing effects.

Subjects

The study was conducted in Ann Arbor, Michigan. The schools selected within this community have predominantly white middle class populations. Students were sampled from one of the two high schools in the community. Elementary and junior high schools were then chosen from schools which feed into this high school. The sample included three elementary schools, five junior high schools and one high school.

The first year sample consists of approximately 350 students from grade levels 5th to 11th inclusive. A larger number of 7th and 9th grade students than other grade levels were chosen since past research has indicated that these might be critical times for student attitude change. In the second year an additional control sample was chosen. This sample of 5th to 12th grade students was drawn from the same schools as the original sample with the addition of one high school. Table 1 provides a summary of the sequential design of this study. Shaie's General Developmental Model is represented by a series of short term longitudinal studies. Each row represents a sample of subjects with repeated measures where applicable. In addition to these longitudinal samples a control sample which was tested the first and only time in 1979 is included in the 1979 testing. The 1970 cohort which was tested only once is part of this control sample.

Instrumentation

Data were collected in several forms: student record data, a

student questionnaire, a parent questionnaire, a teacher questionnaire and classroom observations. Information taken from each student's school record included final grades in mathematics for the past four years (1975-1979) and standardized achievement test scores.

The student questionnaire included measures of expectancies for success, incentive values, perceived ability, perceived task difficulty, sex role identity, sex stereotyping of math as a male domain, perceived cost of success and causal attributional patterns. In addition, measures of the children's perceptions of their parents' and teachers' attitudes regarding the children's abilities were included.

The variables relevant to this paper are summarized in Table 2. Each of the attitudinal variables is measured by a summary index of the questionnaire items listed. The alpha coefficient($_A$) given is a measure of the internal consistency of the scale. The items making up these indices each consist of the stem listed, followed by a 7 point Likert scale with endpoints labeled appropriately. A measure of math aptitude(CHMAAPT) was constructed by taking the mean of standardized measures of the student's past math grades and of standardized scores on the math components of the MAT(Michigan Assessment Test) and the CAT(California Test). A student's attributions for success and failure in math achievement situations were measured through the rank ordering of suggested attributions. In accordance with our belief that different attributional patterns effect a student's perception of ability and expectancy for success an attribution pattern variable was created. This variable divided students into three levels: those with attribution patterns which should lead to low expectancies, those with attribution patterns which should lead to high expectancies and those who exhibit

neither a high or low expectancy pattern.

Analysis

It was Schaie's contention that the application of analysis of variance techniques combined with the use of cross-sectional and longitudinal experimental designs would allow the researcher to assess the unconfounded effects of the three parameters of his General Developmental Model (Schaie, 1965). Such analyses would, it was argued, result in separate estimates of the cohort, time of measurement and age parameters of the model. Schaie's contention was contested on conceptual ground by Baltes and others (see Nesselroade and Baltes, 1974). Adam (1978) has recently demonstrated that unconfounded estimates of the three parameters cannot be obtained. With this evidence in mind, we have accepted Baltes' position vis-a-vis the General Developmental Model. Baltes contended that a given design inevitably confounds two of the three effects. In our design we have chosen age since we were interested in the effects of maturation on attitudes which could be discerned through the examination of intra-individual change over one years time.

We adopted the cross-sequential model of data analysis for use in this investigation. The cross-sequential model varies cohort and time of measurement while confounding chronological age. More concretely, the data analysis of the cross-sequential model was performed as a cohort (7) x sex (2) x time of measurement (2) ANOVA with repeated measures on the factor of time of measurement. Each of the student attitude scales served as a dependent variable in these analyses.

In addition, two series of control analyses were performed. In each case, data from one year of the longitudinal sample was compared to

a control sample of students tested only in the second year. In the first series of control analyses, data from the year one sample tested in 1978 and control sample tested in 1979 were examined for cohort, sex and year of testing effects with a 8 x 2 x 2 fully crossed factorial ANOVA. The absence of year of testing effects is evidence for the greater external validity of the study in terms of its replicability across time. The second series of control analyses used data from the second year and from the control samples. These data were examined for cohort, sex and testing effects. The lack of significant testing effects increases our confidence that practice effects did not bias our longitudinal findings.

FINDINGS

Student Attitudes and Course Plans

Descriptive Analyses.

To assess the effects of grade and sex on the student variables, analyses of variance using grade and sex as the independent variables were performed on each of the student scales. Table 3 presents the means associated with these analyses for the Year 1 and Year 2 samples Table 4 summarizes the results of the analyses of variance.

Descriptive analyses: Sex. Few sex differences emerged. Compared to girls, boys rated their math ability as higher and perceived their parents as having slightly higher estimates of their ability even though there had been no difference between the past math performances of these same boys and girls. In addition, boys in Year 1 rated both their current math courses and advanced math courses as easier than did the girls. Boys and girls did not differ in their perceptions of their

parents' expectancies for them nor in their perceptions of their parents' estimates of the difficulty of current math courses. In looking at the expectancies these students had for their performance in math, we found little or no sex differential in their expectancies for success in their current math courses; but boys did have higher expectancies than girls for success in future math courses. Both boys and girls might have based their current expectancies on recent objective evaluations of their performance, i.e., last year's math grade. But expectancies for the future may depend not only on these objective outcomes, but also on their more general perceptions of their own ability and the difficulty of math. As was mentioned earlier, boys and girls did perceive both of these factors differently. These differing perceptions should be reflected in the attributions assigned to success and failure experiences.

Boys and girls differed in their attributional patterns for success and failure in math achievement situations. Chi square tests of sex by attributions in both years indicated that boys attributed failure less to ability than did girls (Year 1: $X^2 = 9.76$, $p<.05$; Year 2: $X^2 = 9.77$, $p<.05$) and boys attributed success more to ability than girls did (Year 1: $X^2 = 7.99$, $p<.05$; Year 2: $X^2 = 16.0$, $p<.05$). In addition, girls attributed success more to consistent effort than did boys (Year 1: $X^2 = 8.80$, $p<.05$; Year 2: $X^2 = 5.733$, $p=.016$).

These differences in attributional patterns reflect very different perceptions of the task demands of math which may, in turn, affect a student's expectations for future success. The girl for whom consistent effort is seen as a more important cause of her successes than ability could have low future expectancies because future courses are considered

more difficult, demanding even more effort. The amount of effort she can or is willing to expend has limits. Consequently, perceptions of the need for even greater effort may lower her expectancies for future success in math and predispose her against continuing to take math. The same dynamics would not apply to a boy who views his ability rather than his efforts as the more important cause for success in math. He might assume that his ability will allow him to continue performing well with little or no additional effort.

Descriptive analyses: Grade. Grade effects were both more numerous and, in general, stronger than sex effects. What emerges from an inspection of Table 4 is a sense that children become more pessimistic and negative about math as they grow older. The older children had lower expectancies for both their current and future math performance, rated both their math ability and math performance lower, saw both their present and future math courses as more difficult, thought their parents shared these pessimistic views of their abilities and performance potential, were less interested in math activities in general, liked their math teachers less and rated the utility of advanced math courses as lower than the younger children. For most of these variables, there was a consistent downward linear trend as a function of grade with the girls preceding the boys. No consistent grade by sex interactions emerged.

Descriptive analyses: General. Several additional findings emerged that are of interest. Each are discussed in this section.

All students rated math as more useful for males (Year 1, M=5.60; Year 2, M=5.03) than for females (Year 1, M=2.98; Year 2, M=4.22; $p<.0001$ in each year). Students did not, however, rate males as having

more math ability. The stereotyping of math as exclusively useful for males (calculated by subtracting the usefulness for women score from the usefulness for men score and hereafter referred to as the stereotyping of math as a male domain) dropped from Year 1 to Year 2. This drop was due largely to the increase in the rating of the usefulness of math for women from Year 1 to Year 2. Neither grade nor sex influenced these results.

We had the 10th-12th grade, Year 2 students rate the amount of encouragement to continue in math they had received from each of the following sources (listed in descending order of their mean encouragement score): father, mother, last year's teacher, guidance counselor, older friends, siblings and peers. Of these, only fathers, mothers and previous math teacher were perceived as having encouraged the students. The other individuals were perceived as having neither encouraged nor discouraged the students. Peers were <u>not</u> seen as having discouraged the students' decision. One sex difference emerged: boys, in comparison to girls, felt that their counselor had provided them with more encouragement ($p<.05$). Counselor encouragement did not, however, predict future course plans.

The students also rated the importance of various reasons in influencing their decision to take math. Three reasons emerged as the most influential: preparation for either a college major or career, gaining admission to a prestigious college and the importance of math in a well rounded education. Intrinsic properties of math, such as its challenge, ease, or interest value were clearly less important. One sex difference emerged: boys rated the importance of future plans (college or career) in their decision higher than did girls ($p<.01$).

Cross-sequential Analyses. In accordance with Schaie's General Developmental Model we computed a series of ANOVA analyses examining the effects of sex, time of measurement and birth cohort on students' attitudes. Included in these analyses are all students who took the questionnaire in both the first and second years of the data collection. The analyses are summarized in Table 5. In these analyses time differences can interpreted as the "true" longitudinal, cohort specific age changes occurring over the period of one year. However, when evaluating the relative impact of ontogenetic(age-related) versus historical change, you would expect cohort effects to dominate the outcome if indeed grade level is the crucial variable, since the seven cohort groups(1963, 1969) cover average grade level differences amounting to six years(5-6 vs. 6-6 vs. 7-6 vs. 8-6 vs. 9-6 vs. 10-6 vs. 11-6). Conversely, if historical or cultural change effects of the 1978-1979 period are more salient, one would expect time of measurement effects to dominate since time effects involve less confounded age variance(one year) (Nesselroade & Baltes, 1974).

Significant cohort effects were found for the majority of the student attitude scales with the exception of the effort and cost scales. These cohort effects represent the influence of grade on the various dependent measures. The general pattern of results indicates that students in higher grades had more negative attitudes toward mathematics than younger students. These results parallel the descriptive analyses reported earlier.

Time of measurement effects were less frequent than cohort effects. Time effects in these analyses may be thought of as developmental or longitudinal effects; that is, differences in responses attributable to

the passage of one year. Scales reflecting the value of math to the student (utility, liking and cost) and perception of the amount of effort needed to do well showed significant effects for time. In each case, the students' attitudes dropped from 1978 to 1979. They liked their math teachers less, rated the utility of advanced math as lower, and rated the amount of effort required to do well in their current math course and its cost to them as lower. No significant effects of student sex were found in any of these analyses.

REFERENCES

Adam, J. Sequential strategies and the separation of age, cohort, and time-of-measurement contributions to developmental data. Psychological Bulletin, 1978, 85, 1309-1316.

Aiken, L. Update on attitudes and other affective variables in learning mathematics. Review of Educational Research, 1976, 46, 293-311.

Atkinson, J.W. An introduction to motivation. Princeton, N.J.: Van Nostrand, 1964.

Edwards, W. The theory of decision making. Psychological Bulletin, 1954, 51, 380-417.

Fennema, E. Mathematics learning and the sexes: A review. Journal for Research in Mathematics Education, 1974, 126-139.

Fennema, E. & Sherman, J. Sex-related differences in mathematics achievement, spatial visualization and affective factors. American Educational Research Journal, 1977, 14, 51-71.

Fox, L.H. The values of gifted youth. In D.P. Keating (Ed.) Intellectual talent: Research and development. Baltimore: The John Hopkins Press, 1976.

Maccoby, E.E., & Jacklin, C.N. Psychology of sex differences. Palo Alto, California: Stanford University Press, 1974.

Nesselroade, J.R., & Baltes, P.B. Adolescent personality and historical change: 1970-1972. Monographs of the Society for Research in Child Development, 1974, 39,

Schaie, K.W. A general model for the study of developmental problems. Psychological Bulletin, 1965, 64, 92-107.

Weiner, B. Achievement motivation and attribution theory. Morristown, N.J.: General Learning Press, 1974.

TABLE 1

Short Term Longitudinal Sequences for the Study of Development of Attitudes Toward Mathematics: Data Collection and Design

Cohort	Sex	Grade							
		5th	6th	7th	8th	9th	10th	11th	12th
1963	F							1978	1979
	M								
1964	F						1978	1979	
	M								
1965	F					1978	1979		
	M								
1966	F				1978	1979			
	M								
1967	F			1978	1979				
	M								
1968	F		1978	1979					
	M								
1969	F	1978	1979						
	M								
1970	F	1979							
	M								

Note - Entries represent time of measurement. To estimate instrumentation and testing effects, groups of cohorts 1963 - 1970 were observed for the first and only time in 1979.

TABLE 2

MATHEMATICS ATTITUDE SCALES INCLUDED IN THE STUDENT QUESTIONNAIRE

Future Expectancies for Math:FUTEXP

8. How successful do you think you'd be in a career which required mathematical ability? (not very successful/very successful) (V=18)

2. How well do you think you'll do in your mathematics course next year? (not at all well/very well) (V=182)

6. How well do you think you'll do in advanced high school mathematics courses (like Algebra II, Trigonometry, or Calculus)? (not at all well/very well) (V=186)

1b. How well would you expect to do in Trigonometry and Pre-Calculus? (not at all well/very well) (V=232)

2b. How well would you expect to do in this course (Calculus)? (not at all well/very well) (V=234)

3. How well do you think you'll do in your mathematics course next year? (not at all well/very well) (V=273)

2. How well do you think you would do in your mathematics course next year? (not at all well/very well) (V=292)

alpha=.7899

Current Expectancies for Math:CUR, CRNTEXP

7. Compared to other students in your class, how well do you expect to do in mathematics this year? (much worse than other students/much better than other students) (V=17)

48. How well do you expect to do on your next math test? (not at all well/very well) (V=60)

53. How well do you think you will do in your math course this year? (very poorly/very well)

alpha=.8341

TABLE 2 (cont'd.)

Math Ability:ABIL, ABILITY

2. How good at math are you? (not at all good/very good) (V=12)

16. If you were to order all the students in your math class from the worst to the best in math, where would you put yourself? (the worst/the best) (V=26)

36. In comparison to most of your other academic subjects, how good are you at math? (much worse/much better) (V=48)

alpha=.7974

Perceived Math Ability:PERABIL, PERCABIL

13. How good at math does your mother think you are? (not at all good/very good) (V=23)

22. How good at math does your father think you are? (not at all good/very good) (V=32)

19. How good at math does your teacher think you are? (not at all good/very good) (V=29)

alpha=.8164

Difficulty of Current Math:CURDIFF, CRNTDIF

4. In general, how hard is math for you? (very easy/very hard) (V=14)

18. Compared to most other students in your class, how hard is math for you? (much easier/much harder) (V=28)

28. Compared to most other school subjects that you have taken or are taking, how hard is math for you? (my easiest course/my hardest course) (V=38)

alpha=.8118

TABLE 2 (cont'd)

Perceived Difficulty of Current Math:PERDIF

41. How hard does your mother think math is for you? (very easy/very hard) (V=53)

44. How had does your father think math is for you? (very easy/very hard) (V=56)

47. How hard does your teacher think math is for you? (very easy/very hard) (V=59)

alpha=.7870

Effort:COMBEFF

3. How hard do you have to try to get good grades in math? (a little/a lot) (V=13)

33. How hard do you have to study for math tests to get a good grade? (a little/a lot) (V=45)

37. To do well in math I have to work. . . (Check one)
    1) much harder in math than in other subjects.
    2) somewhat harder in math than in other subjects.
    3) a little harder in math than in other subjects.
    4) the same as in other subjects.
    5) a little harder in other subjects than in math.
    6) somewhat harder in other subjects than in math.
    7) much harder in other subjects than in math. (V=49) hard) (V=67)

    How much time do you spend on math homework? Check one.
    a) an hour or more a day

    b) 30 minutes a day
    c) 15-30 minutes a day
    d) about 1 hour a week
    e) about 30 minutes a week
    f) about 30 minutes every two weeks
    g) I rarely do any math homework.

17. How hard do you try in math? (a little/a lot) (V=27)

27. Compared to most other students you know, how much time do you have to spend working on your math assignments? (much less time than other students/a lot more time than other students) (V=37)

alpha=.7595

TABLE 2 (cont'd.)

Utility of Basic Math:BAS.USE, BAS.UTIL (Year 1)*

3. How useful is learning basic math (like adding and dividing) for what you want to do after you graduate and go to work? (not at all useful/very useful)

58. How useful do you think the things you have learned in basic math are for your other school courses? (not very useful/very useful)

alpha = .6137 *Included in Year 1 only

Utility of Advanced Math:ADVUSE, UTIL.AV, FUT.UTIL

9. How useful is what you would learn in high school math (like Algebra II, Trigonometry, or Calculus) for what you want to do when you finish school and go to work? (Not very important/very important) (V=19)

20. How useful is what you would learn in advanced high school math (like Algebra II, Trigonometry, or Calculus) for your daily life outside of school? (not at all useful/very useful) (V=30) (V=271)

alpha=.7522

Importance of Math:IMPORT

23. I feel that, to me, being good at solving problems which involve math or reasoning mathematically is: (not at all important/very important) (V=33)

34. How important is it to you to get good grades in math? (not at all important/very important) (V=46)

38. How upset would you be if you got a low mark in math? (not at all upset/very upset) (V=50)

alpha=.7353

Interest in Math:INTEREST

1. In general, I find working on math assignments (very boring/very interesting) (V=11)

In general, I find working on math games ...(boring/interesting)

31. How much do you like doing math? (not very much/very much) (V=41)

alpha=.8004

TABLE 2 (cont'd.)

Liking for Math Teacher:LIKE.TCHR

49. How much do you like your math teacher? (not very much/very much) (V=61)

alpha unavailable

Perceived Importance of Math to Parent:IMPFORPA

15. How upset do you think your mother would be if you got a low mark in math? (not very much/very much) (V=25)

24. How upset do you think your father would be if you got a low mark in math? (not very much/very much) (V=34)

alpha=.7763

Performance in Math:PERF, PERFORM

32. In math, most of the time, how well do you do in each of the following things?
    a) When the teacher calls on you for an answer in class (very poorly/very well) (V=42)
    b) When taking a test I have studied for (very poorly/very well) (V=43)
    c) When doing math homework problems (very poorly/very well) (V=44)

52. How have you been doing in math this year? (very poorly/very well) (V=64)

alpha=.7614

Minimum Standards For Performance in Math:MINSTAN (Year 2)*

5. What is the lowest grade or evaluation mark you would be satisfied with in your present math course? (V=15)

alpha is unavailable

*Included in Year 2 only

TABLE 2 (Cont'd.)

Anticipated Difficulty of Future Math:FUTDIF

3. How difficult do you think next year's math will be for you? (much easier than this year/much harder than this year) (V=183) (NOTE: V183 used in scale only for 9th graders)

7. How hard do you think advanced high school math will be for you? (very easy/very hard) (V=187)

8. Compared to most other school subjects you may take in high school, how hard do you think advanced high school math will be for you? (my easiest course/my most difficult course) (V=188)

1a. If you took Trigonometry and Pre-Calculus, how hard do you think it would be for you? (not at all hard/very hard) (V=231)

2a. If you took Calculus, how hard do you think it would be for you? (not at all hard/very hard) (V=233)

alpha=.7732

Perceived Expectancies for Math:PERCEXP, PAREXP

45. How well do you think your father expects you to do in math this year? (not very well/very well) (V=57)

57. How well do you think your mother expects you to do in math this year? (not very well/very well) (V=69)

42. How well do you think your teacher expects you to do in math this year? (not very well/very well) (V=54)

alpha=.8672

Cost of Effort To Do Well in Math:COST*

40. Is the amount of effort it will take to do well in your math course this year worthwhile to you? (not very worthwhile/very worthwhile) (V=52)

54. Is the amount of effort it would take to do well in advanced high school math courses (like Algebra II, Trigonometry, or Calculus) worthwhile to you? (not very worthwhile/very worthwhile) (V=66)

57. How much does the amount of time you spend on math keep you from doing other things you would like to do? (takes away no time/ takes away a lot of time) *V(52) included in Year 2 only

alpha=.719

TABLE 2 (cont'd.)

Parent Encouragement to Continue in Math:ENCRG

Rate on a scale of 1 to 7 how much each of the following people have encouraged or discouraged you:

Mother (strongly discouraged me/strongly encouraged me) (V=221)
Father (strongly discouraged me/strongly encouraged me) (V=222)

alpha=.7091

Plans for Future Math Courses:INTENT (Year 1)

41. Would you take more math if you didn't have to? (Check one)
    a) I very definitely would take more math
    b) I probably would take more math
    c) maybe I would take more math
    d) I'm not sure
    e) maybe, but not that likely
    f) I probably would not take any more math
    g) I very definitely would not take any more math (V=543)
    How much more math would you take? (V=739)

1. Do you plan to take any math courses in high school? Yes_____ No_____ How many?
    a) Three years of math
    b) Two years of math
    c) One year of math
    d) None
    Which math courses do you plan to take?

TABLE 2 (cont'd.)

Plans and Future Choices in Math: INTENT (Year 2)

4. Would you take more math if you didn't have to: (Check one)
   1) I very definitely would take more math
   2) I probably would take more math
   3) maybe I would take more math
   4) I'm not sure
   5) maybe, but not that likely
   6) I probably would not take any more math
   7) I very definitely would not take any more math (V=184)

5. How much more math would you take if you did not have to?
   1) I would not take any more math
   2) I would take one or two years of junior high school math
   3) I would take math through ninth grade
   4) I would take math through ninth grade, plus one more year of high school math
   5) I would take math through ninth grade, plus two more years of high school math
   6) I would take math all the way through high school (V=185)

5. What math courses, if any, do you plan to take in the 11th grade? (Please be as specific as you can, for example, Trigonometry and Pre-Calculus, Calculus, etc.)
   a) first semester (V=275)
   b) second semester (V=276)
   c) I do not plan to take math in the 11th grade (V=277)

6. What math courses, if any, do you plan to take in the 12th grade?
   a) first semester (V=278)
   b) second semester (V=279)
   c) I do not plan to take math in the 12th grade (V=280)

TABLE 2 (cont'd.)

Parents' Use of Math:MPARUSE*

56. How much does your mother use math? (not very much/very much)

Sex Stereotyping of the Utility of Math for Women:ST.USE.F

2. How useful do you think women find basic math in their jobs? (not at all useful/very useful)

12. How useful do you think that women find advanced high school math in their jobs? (not at all useful/very useful)

39. How useful do you think women find basic math (like adding and dividing) in their everyday activities? (not at all useful/very useful)

alpha = .742

Sex Stereotyping of the Utility of Math for Men:ST.USE.M

17. How useful do you think men find basic math (like adding and dividing) in their jobs? (not at all useful/very useful)

51. How useful do you think men find basic math in their everyday activities? (not at all useful/very useful)

S1. How useful do you think men find advanced high school math (like Advanced Algebra and Calculus) in their jobs? (not at all useful/very useful)

alpha = .6850

Sex Stereotyping of Math Ability:ST.ABIL,ST.ABIL2*

29. In general, I think boys are...
a) much better than girls at math, b)somewhat better than girls at math, c) a little better than girls at math, d) the same as girls at math, e) a little worse than girls at math, f) somewhat worse than girls at math, g) much worse than girls at math. Why?_____

* Alpha coefficient not available for single item scales.

TABLE 2 (cont'd.)

Math Aptitude and Past History:CHMAAPT

Average of standardized scores on most recent MAT, CAT, and past math grades plus the constant 4.

Math as a Male Domain:MATH.MAL

ST.USE.M minus ST.USE.F scales

Sex Role Identity

Personality attribute questionnaire.

1. Scored as Neutral (Low masculine, Low feminine)
   Masculine (High masculine, Low feminine)
   Feminine (Low masculine, High feminine)
   Androgynous (High masculine, High feminine)

2. Scored as Masculine (MASC)
   Feminine (FEM).

Career Plans

In this section we would like to ask you some questions about your future plans. Please indicate which of the following you plan to do after you graduate from high school.

1.---Continue your education (college, vocational training, etc.). Please indicate what you plan to study in college or the type of vocational training you are interested in. -----

2.---Look for a job. Please indicate the type of job you are interested in.

3.---Other plans (please describe).

Attributions

1. People use different reasons to explain why they have done things well or poorly. Think of the last math test you did not do so well on (one you did poorly on). Why do you think you did so poorly? ---

2. People use different reasons to explain why they have done things well or poorly. Think of the last math test you did well on. Why do you think you did so well? ---

TABLE 2 (cont'd.)

Success Attributions

We are going to give a list of reasons that students often give for why they have done well on a math test. Think about a time when you did very well a math test. Read the list. Then answer the questions at the bottom of the list.

a) I did well on the math test because I am smart in math.

b) I did well on the math test because my teacher helped me learn the math.

c) I did well on the math test because my parents helped me learn math.

d) I did well on the math test because I like math so much.

e) I did well on the math test because I have worked very hard on my math all year.

f) I did well on the math test because I studied very hard for the math test.

g) I did well on the math test because math tests are easy.

h) I did well on the math test because I was feeling so good at the time I took the test.

Pick the reason you think is the most important reason for why you did so well on that math test. Write the letter on that reason here _____ Now cross out that reason with your pencil.

Now pick the reason you think is the next most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the third most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the fourth most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the fifth most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the sixth most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the seventh most important reason and write its letter here _____ Cross out the reason.

TABLE 2 (cont'd.)

Failure Attributions

Now we are going to give a list of reasons that students often give for why they have done poorly on a math test. Think about the times when you didn't do very well on a math test. Read the list. Then answer the questions at the bottom of the list.

a) I did poorly on the math test because I am not very smart in math.

b) I did poorly on the math test because my teacher did not give me as much help as I needed.

c) I did poorly on the math test because my parents did not give me as much help as I needed.

d) I did poorly on the math test because I don't like math very much.

e) I did poorly on the math test because I have not worked very hard in math this year.

f) I did poorly on the math test because I didn't study hard enough for the test.

g) I did poorly on the math test because the math test was hard.

h) I did poorly on the math test because I was not feeling very good at the time I took the test.

Pick the reason you think is the most important reason for why you did so poorly on that test. Write the letter of that reason here _____. Now cross out that reason with your pencil.

Now pick the reason you think is the next most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the third most important reason and write its letter here_____ Cross out the reason.

Now pick the reason you think is the fourth most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the fifth most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the sixth most important reason and write its letter here _____ Cross out the reason.

Now pick the reason you think is the seventh most important reason and write its letter here _____ Cross out the reason.

TABLE 3

MEAN VALUES FOR ATTITUDINAL SCALES WITHIN GRADE AND SEX FOR TWO YEARS

YEAR GRADE	SEX	PAQ FEM	PAQ MASC	INTENT	CHMA APT	COST CUR	COST ADV	CAB CN	CTSK CN	CVAL CN	FUT UTIL	BAS UTIL	PER ENCRG	PER DIF	PER ABCN	T ABCH	BPAR IMP	FATH TD	MOTH TD	BPAR ABCN	N
YEAR 1 5TH	FEMALE	4.27	3.93	5.66	3.52	3.11	5.77	5.46	3.93	5.71	5.81	5.77	5.47	3.41	6.11	5.16	10.60	7.62	6.66	8.93	8
	MALE	4.07	3.78	5.46	4.03	3.61	5.92	5.74	3.79	6.07	6.03	5.76	6.36	3.00	6.53	5.62	11.90	7.45	6.54	9.27	13
	ALL	4.14	3.84	5.54	3.80	3.40	5.86	5.63	3.84	5.92	5.94	5.77	6.00	3.17	6.36	5.42	11.40	7.52	6.59	9.13	
YEAR 2 5TH	FEMALE	4.12	1.65	2.93	--	2.80	5.62	5.39	4.10	5.55	--	--	--	2.81	5.82	5.25	--	--	--	--	30
	MALE	3.88	1.92	3.32	--	3.00	5.16	5.17	4.10	5.17	--	--	--	2.96	5.60	5.07	--	--	--	--	25
	ALL	4.01	1.77	3.10	--	2.89	5.40	5.29	4.10	5.38	--	--	--	--	--	--	--	2.87	5.72	5.17	
YEAR 1 6th	FEMALE	4.19	3.63	4.81	4.03	3.63	5.27	5.25	4.11	5.43	5.27	5.72	5.65	3.40	5.97	5.00	11.20	8.77	6.77	8.63	11
	MALE	3.73	3.83	5.00	4.19	3.14	5.71	5.70	3.86	5.32	5.47	5.42	5.85	3.21	6.32	5.71	11.00	6.62	5.80	9.25	7
	ALL	4.01	3.71	4.88	4.09	3.44	5.44	5.43	4.01	5.39	5.35	5.61	5.73	3.33	6.11	5.27	11.10	8.11	6.42	8.85	
YEAR 2 6th	FEMALE	4.16	1.58	2.80	--	3.52	5.85	5.20	4.07	5.29	--	--	--	3.59	5.81	4.32	--	--	--	--	21
	MALE	3.95	1.74	2.82	--	2.73	6.00	5.34	4.11	5.58	--	--	--	3.68	5.95	4.95	--	--	--	--	22
	ALL	4.05	1.67	2.81	--	3.11	5.93	5.27	4.09	5.44	--	--	--	3.64	5.88	4.64	--	--	--	--	
YEAR 1 7th	FEMALE	4.03	3.48	5.01	3.82	3.84	5.13	4.61	4.58	5.07	5.14	5.09	5.58	3.95	5.20	4.65	10.80	9.64	8.04	8.69	50
	MALE	3.87	3.91	5.08	3.90	3.28	5.26	4.99	4.31	5.17	5.24	5.39	5.46	3.85	5.45	4.94	10.80	8.33	7.13	8.98	46
	ALL	3.96	3.68	5.05	3.86	3.58	5.19	4.79	4.45	5.12	5.19	5.23	5.52	3.90	5.32	4.79	10.80	8.96	7.58	8.84	
YEAR 2 7th	FEMALE	4.04	1.44	2.54	--	3.35	5.22	4.80	4.05	5.05	--	--	--	3.55	5.43	5.09	--	--	--	--	25
	MALE	3.76	1.86	3.02	--	3.42	4.62	4.87	4.22	4.83	--	--	--	3.59	5.58	5.12	--	--	--	--	35
	ALL	3.89	1.67	2.80	--	3.39	4.90	4.83	4.14	4.93	--	--	--	3.57	5.51	5.10	--	--	--	--	
YEAR 1 8th	FEMALE	3.87	3.52	5.60	4.34	3.26	4.80	5.04	4.16	4.76	4.64	4.78	4.84	3.40	5.39	6.21	10.10	9.81	7.84	8.54	16
	MALE	3.95	3.99	5.82	3.89	3.58	5.35	5.02	4.37	5.25	5.31	5.64	5.55	4.12	5.36	6.02	10.90	8.25	6.58	8.60	17
	ALL	3.91	3.76	5.71	4.11	3.43	5.09	5.03	4.27	5.02	4.99	5.22	5.21	3.77	5.37	6.12	10.50	9.07	7.28	8.57	
YEAR 2 8th	FEMALE	4.05	1.48	2.55	--	4.05	5.08	4.65	4.17	4.80	--	--	--	3.66	5.48	4.95	--	--	--	--	58
	MALE	3.86	1.61	2.73	--	3.34	4.92	4.82	4.14	4.79	--	--	--	3.72	5.37	5.04	--	--	--	--	52
	ALL	3.97	1.54	2.64	--	3.72	5.00	4.73	4.16	4.79	--	--	--	3.69	5.43	4.99	--	--	--	--	
YEAR 1 9th	FEMALE	4.05	3.67	6.06	4.36	4.27	5.18	4.76	4.78	5.11	4.97	5.64	5.24	4.14	5.29	5.45	10.40	8.83	7.53	9.11	72
	MALE	3.69	3.88	6.29	4.20	3.86	5.44	4.85	4.46	5.31	5.42	5.85	5.49	3.94	5.26	5.20	11.00	7.91	6.47	9.19	58
	ALL	3.89	3.76	6.16	4.29	4.09	5.30	4.80	4.63	5.20	5.17	5.73	5.35	4.05	5.28	5.33	10.60	8.45	7.11	9.14	
YEAR 2 9th	FEMALE	4.09	1.33	1.81	--	4.58	5.22	4.64	4.24	4.66	--	--	--	3.73	5.40	5.60	--	--	--	--	48
	MALE	3.79	1.69	2.20	--	4.59	5.40	4.66	4.30	4.88	--	--	--	4.04	5.31	4.92	--	--	--	--	44
	ALL	3.96	1.49	2.00	--	4.58	5.31	4.65	4.27	4.76	--	--	--	3.88	5.36	5.26	--	--	--	--	
YEAR 1 10th	FEMALE	4.28	3.72	6.50	--	3.60	5.60	4.86	4.97	5.42	5.45	6.20	5.52	4.10	5.52	5.22	11.20	9.14	6.26	9.46	10
	MALE	3.57	3.83	4.50	--	4.00	6.00	5.34	4.19	5.81	5.93	6.75	5.75	4.62	5.12	5.00	11.00	8.50	--	13.00	2
	ALL	4.20	3.74	6.16	--	3.66	5.66	4.94	4.82	5.49	5.53	6.29	5.56	4.18	5.45	5.18	11.10	9.06	6.26	9.90	
YEAR 2 10th	FEMALE	3.94	1.76	2.26	--	3.74	4.70	4.65	4.11	4.26	--	--	5.63	3.82	5.21	--	--	--	--	--	71
	MALE	3.76	2.04	2.04	--	3.28	4.97	4.96	3.88	4.79	--	--	6.11	3.38	5.51	--	--	--	--	--	49
	ALL	3.87	1.87	2.17	--	3.55	4.81	4.77	4.02	4.47	--	--	5.83	3.64	5.33	--	--	--	--	--	
YEAR 1 11th	FEMALE	3.94	3.73	5.60	--	3.80	6.80	4.66	5.43	6.22	6.55	6.30	5.10	4.70	5.05	4.00	9.87	10.10	9.50	9.00	5
	MALE	3.78	3.48	6.33	--	3.66	6.00	4.56	5.27	5.83	6.02	6.50	5.20	5.00	5.16	3.75	11.70	8.90	9.26	9.37	6
	ALL	3.85	3.60	6.00	--	3.72	6.36	4.61	5.34	6.00	6.26	6.40	5.15	4.86	5.11	3.86	11.00	9.44	9.37	9.22	
YEAR 2 11th	FEMALE	4.01	1.75	2.26	--	3.36	5.00	4.15	4.42	4.70	--	--	5.81	4.29	4.87	--	--	--	--	--	19
	MALE	3.79	2.10	1.21	--	3.64	5.78	5.19	3.68	5.34	--	--	5.32	3.14	5.84	--	--	--	--	--	14
	ALL	3.91	1.91	1.81	--	3.48	5.33	4.59	4.11	4.97	--	--	5.60	3.80	5.28	--	--	--	--	--	
YEAR 1 12th	FEMALE	4.19	1.95	2.15	--	4.21	5.05	4.33	4.40	4.66	--	--	5.76	4.22	4.99	--	--	--	--	--	19
	MALE	3.99	2.03	1.79	--	3.50	4.73	4.58	4.09	4.71	--	--	5.79	3.88	4.94	--	--	--	--	--	23
	ALL	4.07	2.00	1.95	--	3.81	4.88	4.47	4.23	4.69	--	--	5.77	4.03	4.96	--	--	--	--	--	

Table 5 (Continued)

MEAN VALUES FOR ATTITUDINAL SCALES WITHIN GRADE AND SEX FOR TWO YEARS

YEAR GRADE	SEX	CRNT DIF	FUT DIF	FUT EXP	CUR EX	COMB EX	ABIL	COST	COMB EFF	UTIL ADV	IMPORT	LIKE INT	TCHR	PERF	ST. USEF	ST. USEM	MATH MALE	ST. ABIL	N
YEAR 1																			
5th	FEMALE	3.29	4.83	5.59	5.77	5.68	5.29	4.44	4.25	5.88	6.18	4.92	6.22	5.97	2.55	6.00	3.44	4.22	9
	MALE	2.97	4.07	5.94	5.89	5.92	5.69	4.76	4.13	6.26	6.46	5.94	6.07	6.15	3.10	5.88	2.78	4.15	13
	ALL	3.10	4.38	5.80	5.84	5.82	5.53	4.63	4.18	6.11	6.34	5.53	6.13	6.07	2.87	5.93	3.05	4.18	
YEAR 2																			
5th	FEMALE	2.93	---	5.25	5.70	5.47	5.23	2.58	4.36	5.27	6.06	5.01	6.10	5.73	5.28	5.73	0.45	4.43	30
	MALE	3.24	---	5.05	5.52	5.28	5.02	2.92	4.65	4.88	5.55	5.06	5.88	5.50	4.42	5.30	0.88	4.00	25
	ALL	3.07	---	5.16	5.61	5.38	5.13	2.73	4.49	5.09	5.83	5.03	6.00	5.63	4.89	5.53	0.64	4.23	
YEAR 1																			
6th	FEMALE	3.51	4.72	5.30	5.66	5.48	5.12	4.45	4.41	5.27	5.57	5.33	6.54	5.70	3.12	6.00	2.87	4.00	11
	MALE	3.00	4.35	5.90	6.19	6.04	5.61	4.42	4.29	5.00	5.76	4.71	5.85	5.82	2.52	5.92	3.40	3.85	7
	ALL	3.31	4.58	5.53	5.87	5.70	5.31	4.44	4.36	5.16	5.64	5.09	6.27	5.75	2.88	5.97	3.08	3.94	
YEAR 2																			
6th	FEMALE	3.39	4.80	5.18	5.53	5.35	5.12	2.83	4.71	4.75	5.68	4.68	5.90	5.59	4.70	5.86	1.15	3.86	22
	MALE	3.26	4.60	5.34	5.60	5.47	5.28	2.36	4.40	5.28	5.75	5.05	5.65	5.75	4.78	5.67	0.89	3.86	23
	ALL	3.32	4.70	5.26	5.57	5.41	5.20	2.59	4.55	5.02	5.71	4.87	5.77	5.67	4.74	5.76	1.02	3.86	
YEAR 1																			
7th	FEMALE	4.15	5.15	4.67	4.82	4.73	4.60	4.49	4.82	5.16	5.74	4.23	5.49	5.11	2.95	5.54	2.57	3.90	53
	MALE	3.63	4.91	5.07	5.29	5.18	4.94	4.27	4.64	5.23	5.56	4.45	5.69	5.29	3.17	5.53	2.35	4.02	47
	ALL	3.91	5.04	4.86	5.04	4.95	4.76	4.39	4.73	5.20	5.65	4.34	5.58	5.20	3.05	5.54	2.46	3.95	
YEAR 2																			
7th	FEMALE	3.58	4.90	4.74	5.09	4.91	4.54	3.06	4.59	4.59	5.70	4.76	5.48	5.20	4.72	5.30	0.58	4.32	31
	MALE	3.90	4.82	4.92	5.29	5.10	4.79	3.40	4.90	4.27	5.36	4.79	5.62	5.25	4.28	5.15	0.87	3.85	35
	ALL	3.75	4.86	4.83	5.20	5.02	4.67	3.24	4.75	4.42	5.52	4.77	5.56	5.22	4.49	5.22	0.73	4.07	
YEAR 1																			
8th	FEMALE	3.35	5.04	4.91	4.95	5.02	5.13	4.03	4.49	4.35	5.37	4.44	5.40	5.56	3.02	5.33	2.31	3.66	15
	MALE	3.84	4.92	5.16	5.27	5.25	5.01	4.47	4.64	5.25	5.76	4.27	6.00	5.48	3.32	5.47	2.14	3.68	17
	ALL	3.61	4.98	5.05	5.12	5.14	5.07	4.26	4.57	4.83	5.58	4.35	5.71	5.52	3.18	5.40	2.22	3.67	
YEAR 2																			
8th	FEMALE	4.03	5.21	4.57	4.92	4.74	4.62	3.48	4.79	4.02	5.76	4.27	5.38	5.19	4.46	5.29	0.83	3.98	39
	MALE	3.89	5.12	4.79	5.22	5.00	4.80	3.21	4.66	4.44	5.46	4.47	5.03	5.22	4.19	4.98	0.78	3.83	33
	ALL	3.97	5.17	4.67	5.06	4.87	4.70	3.35	4.73	4.22	5.62	4.36	5.22	5.20	4.33	5.14	0.81	3.91	
YEAR 1																			
9th	FEMALE	4.15	5.43	4.92	5.06	5.05	4.73	4.72	5.09	4.62	5.74	4.37	4.73	5.26	2.75	5.62	2.87	3.77	72
	MALE	3.85	5.31	5.10	4.93	5.05	4.93	4.65	4.73	5.37	5.76	4.12	4.63	5.14	3.36	5.43	2.02	3.84	58
	ALL	4.02	5.37	5.00	5.00	5.05	4.82	4.69	4.93	4.96	5.75	4.26	4.69	5.21	3.01	5.54	2.50	3.80	
YEAR 2																			
9th	FEMALE	4.32	5.49	4.70	5.00	4.85	4.61	3.67	5.18	3.47	5.76	4.70	4.87	5.20	4.02	4.77	0.75	4.12	48
	MALE	4.34	5.61	4.94	5.00	4.97	4.68	3.59	5.19	4.18	5.75	4.37	4.63	5.02	3.90	4.93	1.02	4.02	44
	ALL	4.33	5.55	4.82	5.00	4.91	4.64	3.63	5.18	3.81	5.76	4.54	4.76	5.11	3.96	4.84	0.88	4.07	
YEAR 1																			
10th	FEMALE	4.13	4.28	5.18	4.83	4.97	4.93	4.75	5.26	5.20	5.93	4.20	5.40	5.37	3.00	6.16	3.16	3.90	10
	MALE	4.00	4.37	5.83	5.66	5.66	5.33	5.00	4.29	5.83	6.16	4.33	4.00	5.87	2.66	6.33	3.66	4.00	2
	ALL	4.11	4.29	5.29	5.00	5.11	5.00	4.80	5.06	5.30	5.97	4.22	5.16	5.45	2.94	6.19	3.25	3.91	
YEAR 2																			
10th	FEMALE	4.05	5.47	4.55	5.04	4.79	4.57	3.52	4.90	3.31	5.47	4.13	4.56	5.16	3.88	4.68	0.80	3.93	72
	MALE	3.68	5.40	4.91	5.38	5.15	4.93	3.15	4.54	4.30	5.60	4.20	5.10	5.26	3.82	4.71	0.89	3.97	49
	ALL	3.90	5.44	4.70	5.18	4.93	4.72	3.37	4.75	3.71	5.52	4.16	4.78	5.20	3.86	4.69	0.83	3.95	
YEAR 1																			
11th	FEMALE	4.93	5.44	5.16	5.13	5.26	4.80	5.30	5.68	6.13	6.33	5.53	6.80	5.15	2.60	6.26	3.66	4.60	5
	MALE	5.11	4.76	5.38	4.72	4.94	4.55	4.83	5.35	6.05	5.44	5.16	6.83	5.29	2.38	6.27	3.88	4.16	6
	ALL	5.03	5.07	5.28	4.90	5.09	4.66	5.04	5.50	6.09	5.84	5.33	6.81	5.22	2.48	6.27	3.78	4.36	
YEAR 2																			
11th	FEMALE	4.50	5.55	4.17	4.56	4.36	4.01	3.18	5.32	3.63	5.66	4.22	5.00	4.55	4.00	4.81	0.81	3.63	19
	MALE	3.42	4.65	5.31	5.35	5.33	5.35	2.92	4.59	4.32	6.19	4.73	4.71	5.37	3.64	4.46	0.82	3.38	14
	ALL	4.05	5.18	4.65	4.89	4.77	4.58	3.07	5.01	3.92	5.88	4.44	4.87	4.90	3.84	4.66	0.82	3.53	
YEAR 2																			
12th	FEMALE	4.64	---	4.84	4.99	4.66	4.24	3.57	5.42	3.89	5.33	4.47	4.47	4.72	3.94	4.57	0.63	3.84	19
	MALE	4.26	---	5.16	4.73	4.98	4.73	3.33	4.78	4.22	4.83	4.69	4.78	4.61	3.83	4.58	0.75	3.66	24
	ALL	4.43	---	5.02	4.61	4.84	4.51	3.44	5.06	4.08	5.05	4.59	4.64	4.66	3.88	4.58	0.70	3.74	

TABLE 4

SUMMARY OF SIGNIFICANT RESULTS FROM ANALYSES OF VARIANCE:

Variables yielding significant sex effects	Effect	F
Year 1		
COMBEFT	F>M	.01
ST.USE.F	M>F	.01
MATH.MAL	F>M	.05
FEM	F>M	.0001
MASC	M>F	.0001
CABCN	M>F	.05
CTSKCN	F>M	.05
BPARIMP	M>F	.01
FATHTD	F>M	.01
MOTHTD	F>M	.01
FUTEXP	M>F	.01
CRNTDIFF	F>M	.01
FUTDIFF	F>M	.01
Year 2		
ABILITY	M>F	.01
COMBEFT	F>M	.01
UTIL.ADV	M>F	.001
ST.USE.F	F>M	.05
ST.ABIL	F>M	.05
FEM	F>M	.0001
MASC	M>F	.0001
CABCN	M>F	.05
UTIL	M>F	.01
FUTEXP	F<M	.01
CURNTEXP	F<M	.04

TABLE 4 (cont'd.)

Variables yielding significant grade effects	Effect	F
Year 1		
ST.USE.M	CURV. U[1]	.01
ST.ABIL	CURV. U	.05
CHMAAPT	O>Y[2]	.01
CABCN	Y>O[3]	.001
CTSKCN	O>Y	.0001
CVALCN	CURV. U	.01
PERDIFCR	O>Y	.01
PERABCN	Y>O	.0001
TABCH	Y>O	.0001
MOTHTD	O>Y	.05
IMPORT	5th>O	.01
CRNTEXP	Y>O	.01
ABIL	Y>O	.01
CURDIF	O>Y	.001
UTIL.AV	Y>O	.001
INTEREST	Y>O	.01
LIKETCHR	Y>O	.01
PERF	Y>O	.01
PERCEXP	Y>O	.01
Year 2		
ST.USE.F	Y>O	.0001
ST.USE.M	Y>O	.0001
ST.ABIL	Y>O	.001
MASC	CURV. U	.0001
CABCN	Y>O	.0001
PERDIFCR	O>Y	.0001
PERABCN	Y>O	.0001
CUREX	Y>O	.001
ABILITY	Y>O	.01
CRNTDIF	O>Y	.001
UTIL.ADV	Y>O	.001
INTEREST	Y>O	.01
LIKETCHR	Y>O	.0001
PERF	Y>O	.0001
FUTDIF	O>Y	.0001
PERCEXP	Y>O	.0001

1 CURV. U=curvilinear relationship with age, decreasing and then increasing

2 O>Y=linear trend increasing with age

3 Y>O=linear trend decreasing with age

TABLE 5

ANALYSIS OF VARIANCE OF STUDENTS' ATTITUDES TOWARD MATH:
YEAR 1 AND YEAR 2 SAMPLES

Effect	Scale																	
	FUT EXP	CRNT EXP	ABILITY	PAR ABIL	CUR DIF	PER DIFF	COMB EFT	UTIL. ADV	IMPORT	INTEREST	LIKE TCHR	PAR. IMPT	PERF	FUT DIF	PERC EXP	COST	MIN STAN
Cohort (C)	**	**	**	**	**	**		**	*	**	**	*	**	**	**		**
Sex (S)																	
Time (T)	*			*			**	**	*		**					**	
CS																	
CT		*									**						
TS														*			
TCS																	

*p≤.05

**p≤.01

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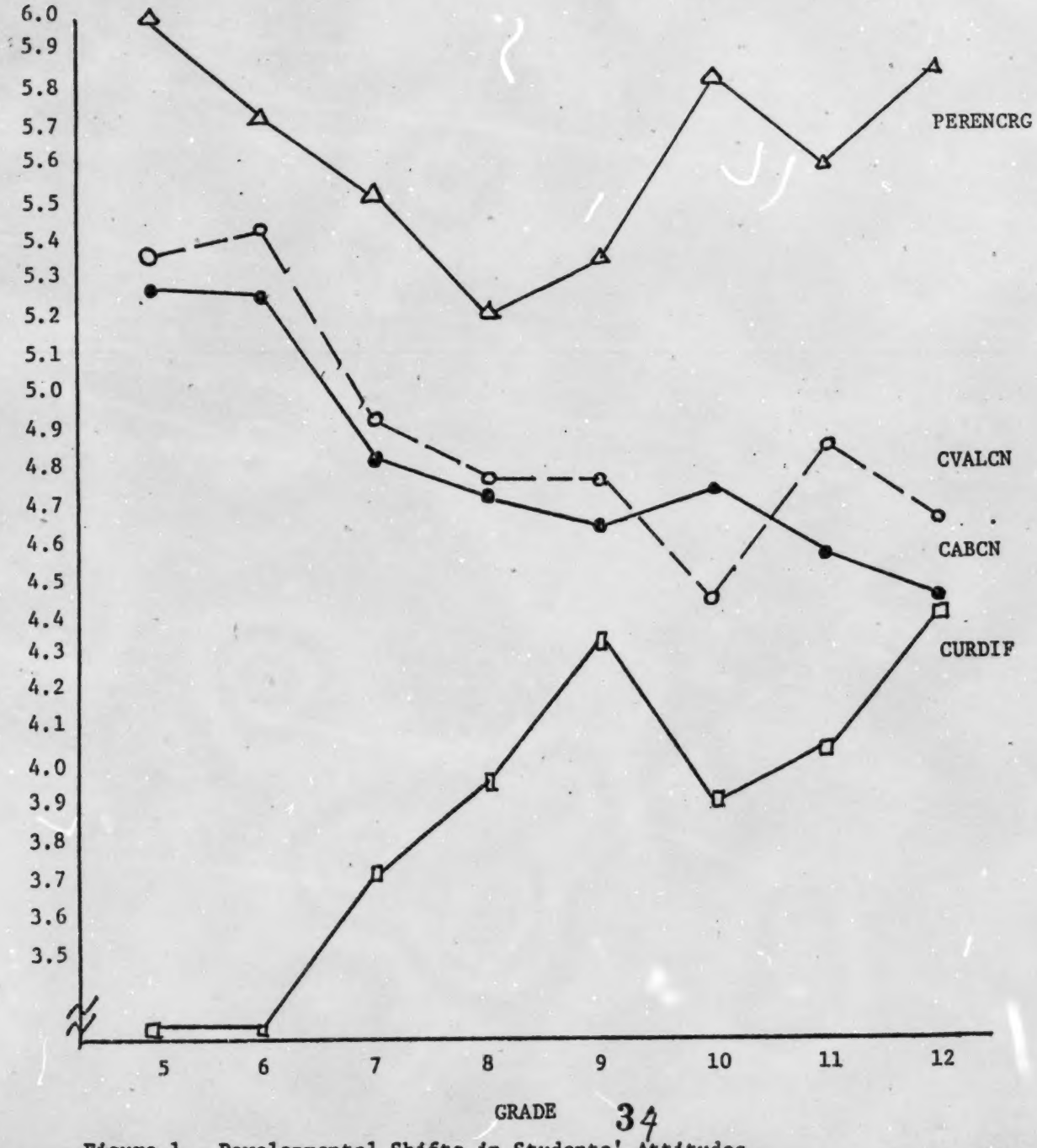

Figure 1. Developmental Shifts in Students' Attitudes